



Wetland Values and the Environment



THE WETLANDS INITIATIVE

The simple logic of environmental management:

- The state of our environment is a matter of land use
- Land use is a matter of economics
- Therefore, economics control the environment

What about our aquatic environment?

- ❑ Problems
 - ❑ Flood damage
 - ❑ Degraded water quality
 - ❑ Reduced wildlife
 - ❑ Limited biodiversity
- ❑ Solution
 - ❑ Wetlands



Pre-settlement: Wetlands



Settlement: Drainage



Today: Concrete and Steel

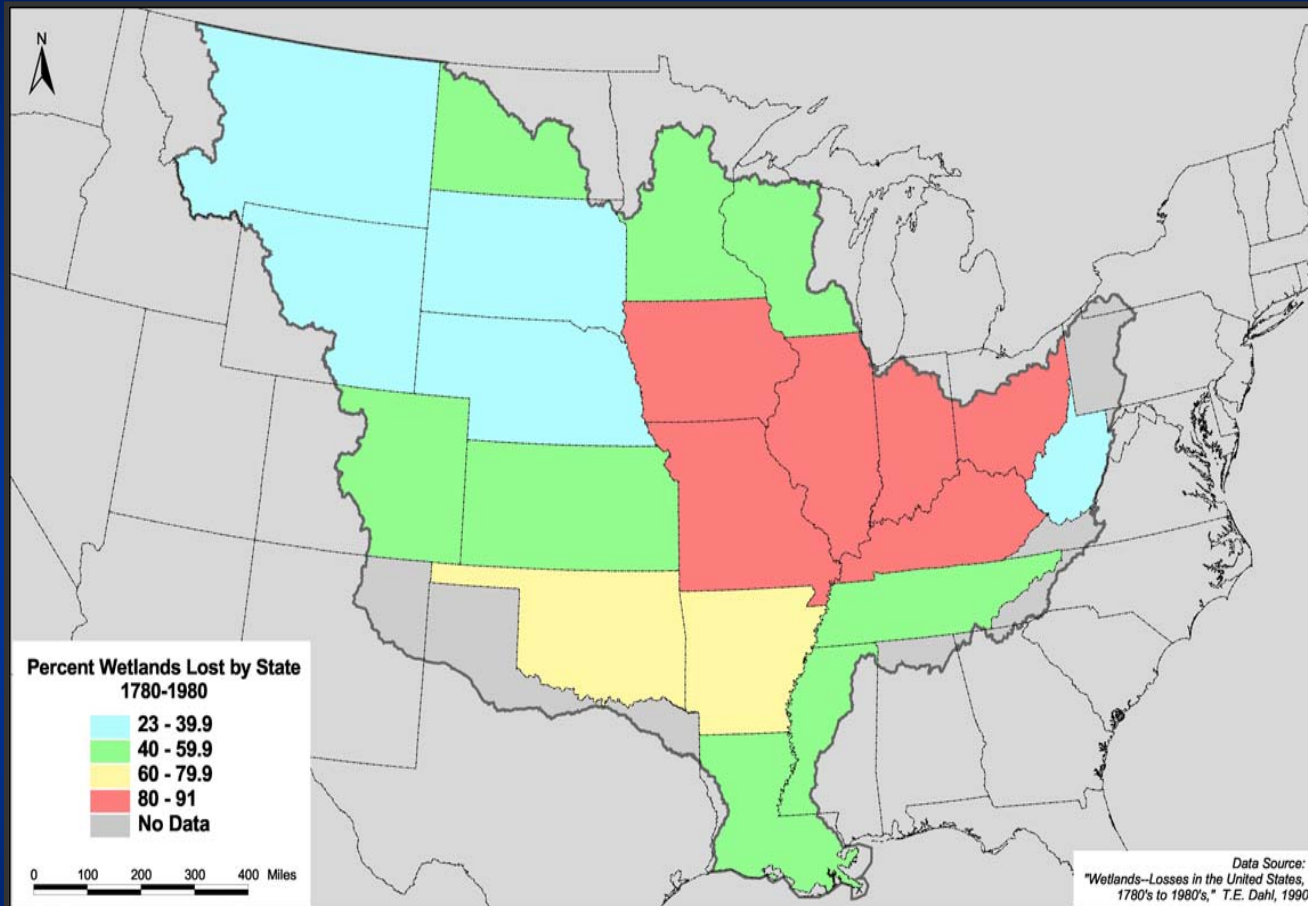
Why is it not more diverse, more functional,
more to our liking?

Use Category	Unit Value (\$/acre)
■ Recreation	1,000
■ Row-crop	3,000
■ Suburban	25,000
■ Urban	100,000
■ Commercial	2,000,000

And, what of these values?

Ecosystem Use	Unit Value (\$/acre)
■ Floodwater Storage	?
■ Nutrient Management	
■ Nitrogen	?
■ Phosphorous	?
■ Carbon	?
■ Sediment Control	?
■ Wildlife habitat	?
■ Biodiversity	?

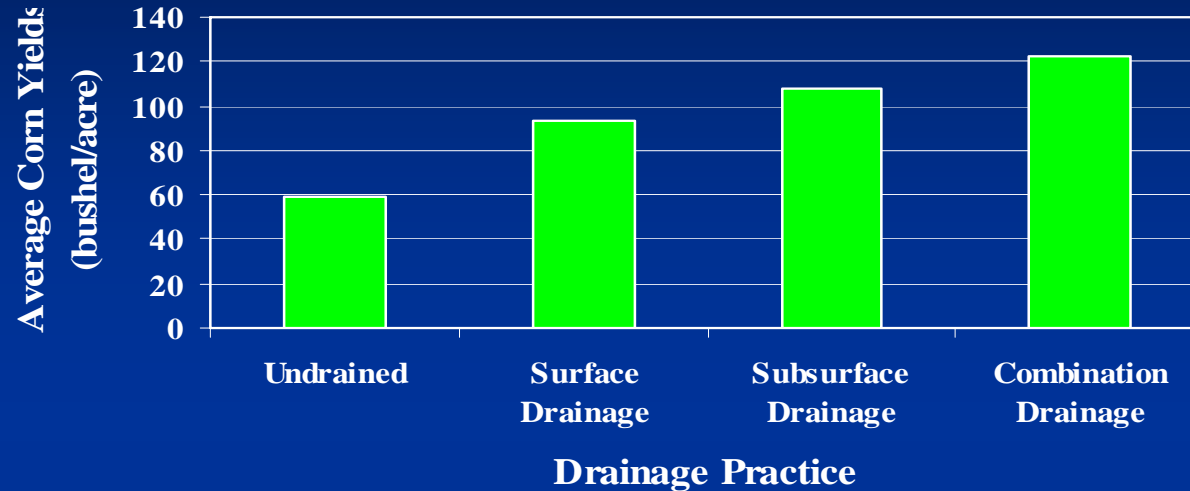
Wetland Losses: Mississippi River Basin



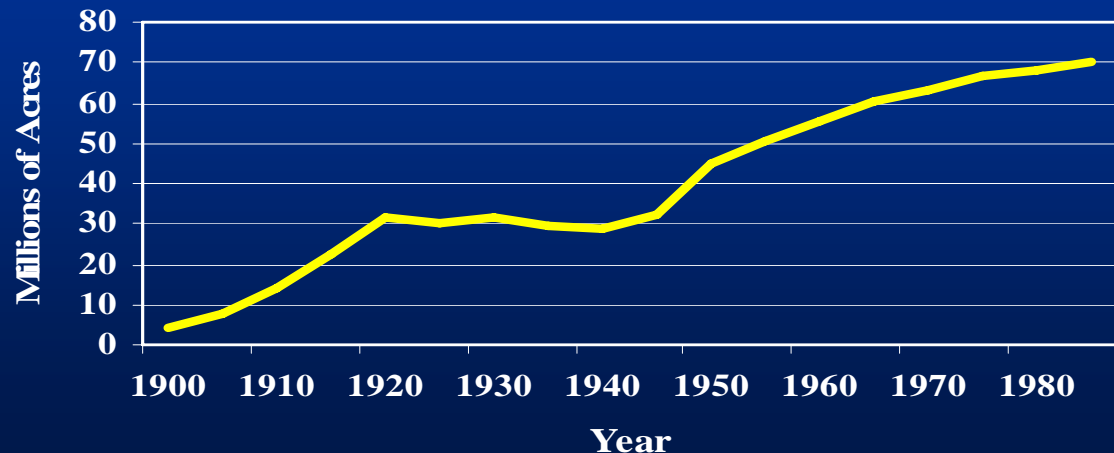
- Percentage of wetlands lost in the United States, 1780-1980
- Positively corresponds with the area of land drained in the Mississippi-Atchafalaya River Basin

Agricultural drainage: pros and cons

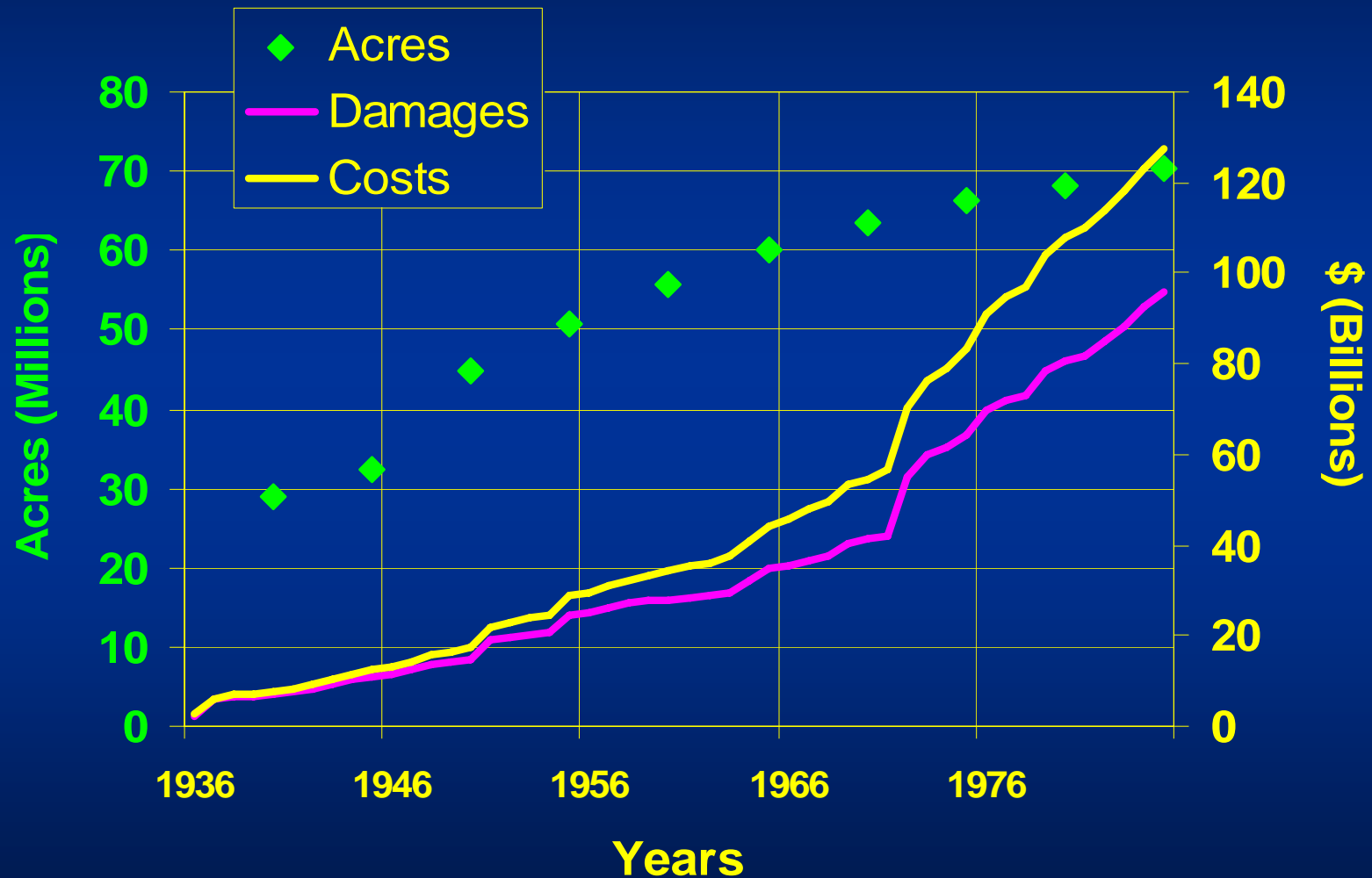
Drainage Benefits



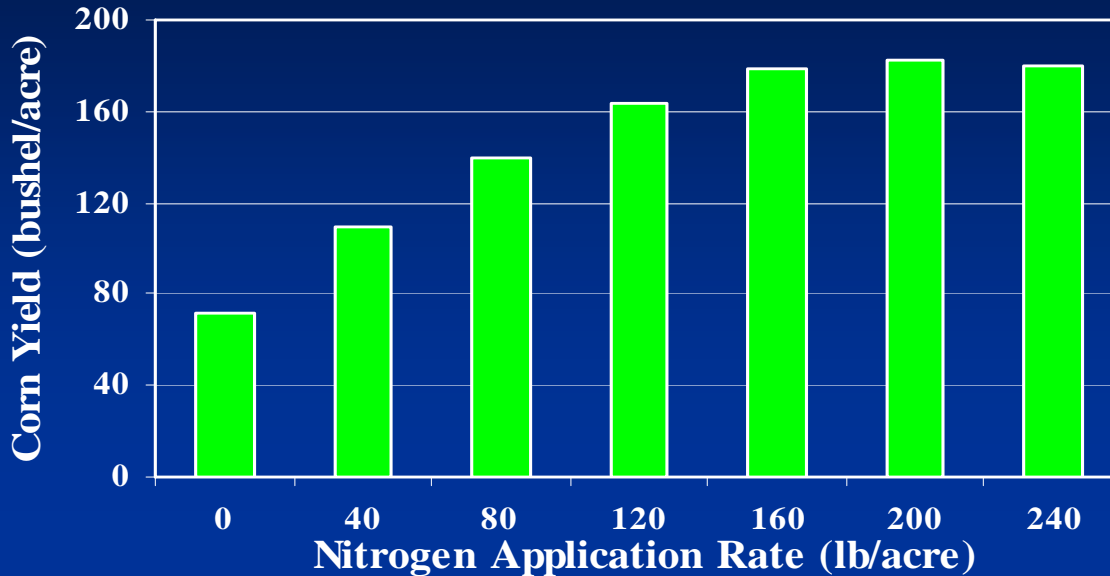
Area Drained: Mississippi River Basin



Cumulative flood damage and control costs (1985 dollars)



Nitrogen benefits and use

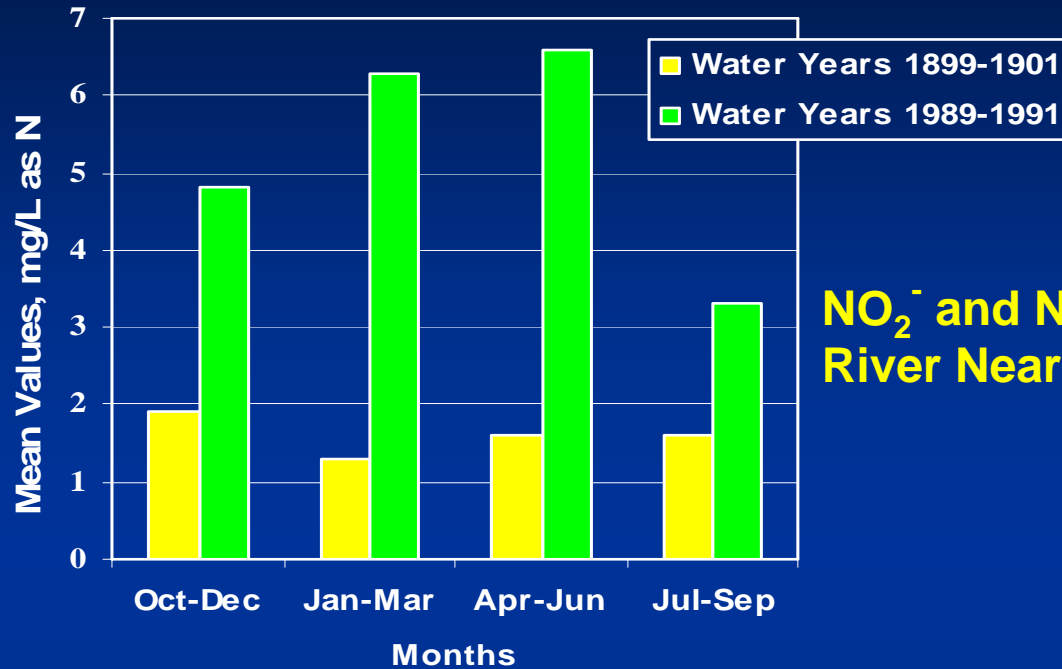


- Effect of nitrogen application rate on corn yield

- Annual Nitrogen Fertilizer Usage: Mississippi-Atchafalaya River Basin

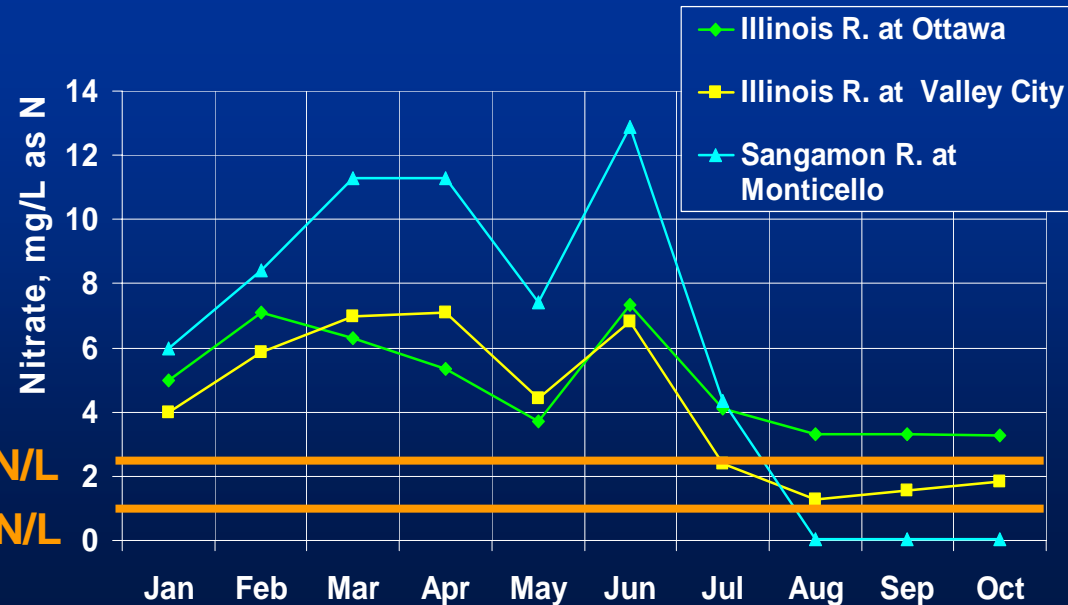


Nitrogen in the water



NO_2^- and NO_3^- Concentrations in the Illinois River Near Peoria, 1900 and 1990

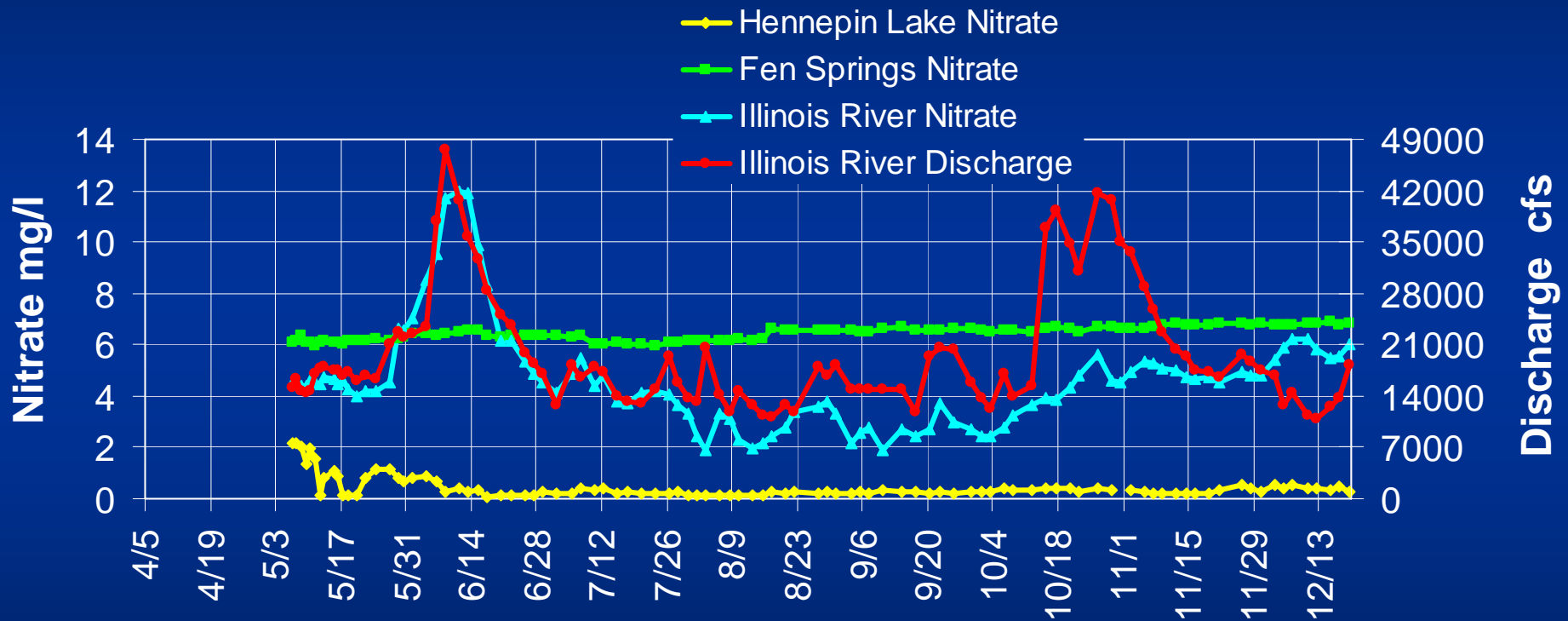
2001 Illinois River $\text{NO}_3\text{-N}$ Levels



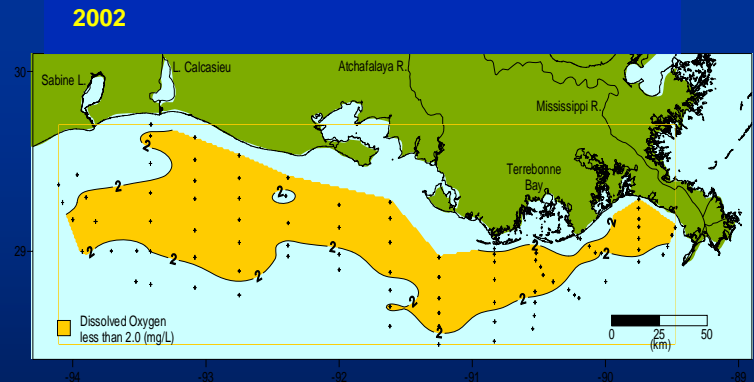
USEPA Ecoregion Criteria: 2.14 mg TN/L

USEPA Ecoregion Criteria 1.6 mg $\text{NO}_3\text{-N/L}$

Nutrient farming could control nitrogen...



And, what about water quality? Hypoxia in the Gulf of Mexico is a good place to start.



Of the nitrogen loads reaching the Gulf of Mexico, the Illinois River contributes more than its fare share.

- ❑ The Illinois River contributes 3% of the flow but 12% (126,000 tons) of the total yearly $\text{NO}_3\text{-N}$ load
- ❑ To reach pre-1970's $\text{NO}_3\text{-N}$ loads to the Gulf of Mexico (350,000 tons/year) requires a load reduction of 700,000 tons/year in the Mississippi River and 100,000 tons/year in the Illinois River
- ❑ For the Illinois River, the solution requires 10 percent of drained wetlands to be restored, which would occupy 32 percent of FEMA floodplain

	Acres	% Watershed
Wetlands required	407,000	2.0
Wetlands drained	4,170,000	20.0
FEMA Floodplain	1,280,000	6.3

Summary

Wetlands provide:

- ❑ Flood control and sediment retention
- ❑ Self-sustaining nutrient management
- ❑ Wildlife habitat and recreational opportunities



FINANCING RESTORATION

Water Quality/Nutrient Trading

Nutrient Farming

Cost Comparison

Market Structure



WATER QUALITY/NUTRIENT TRADING



- Exchange of credits between sources to meet regulatory objectives or water quality goals.
- Partnership between USDA and USEPA
- Incentives to farmers/ranchers who implement conservation practices that improve water quality

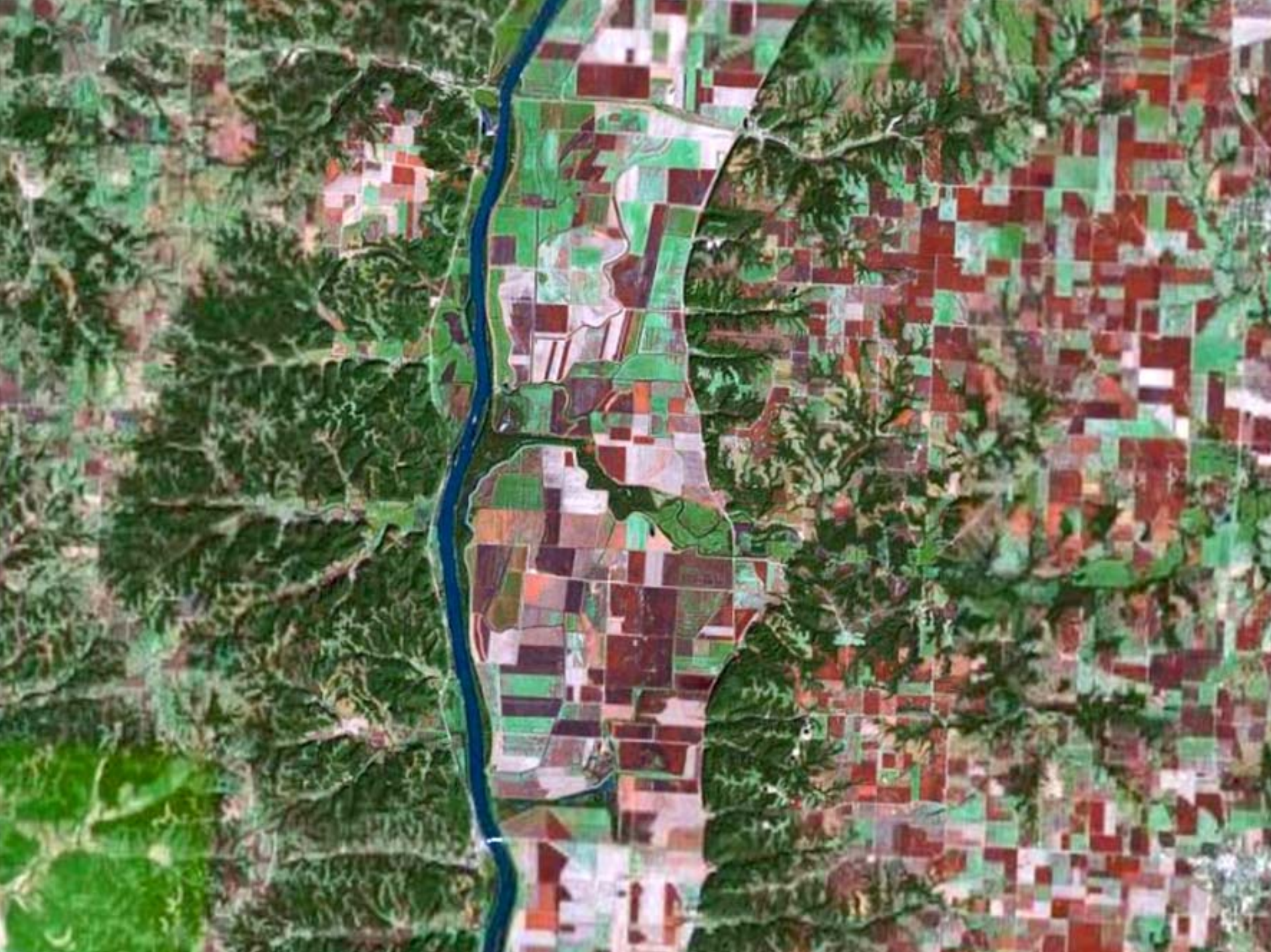


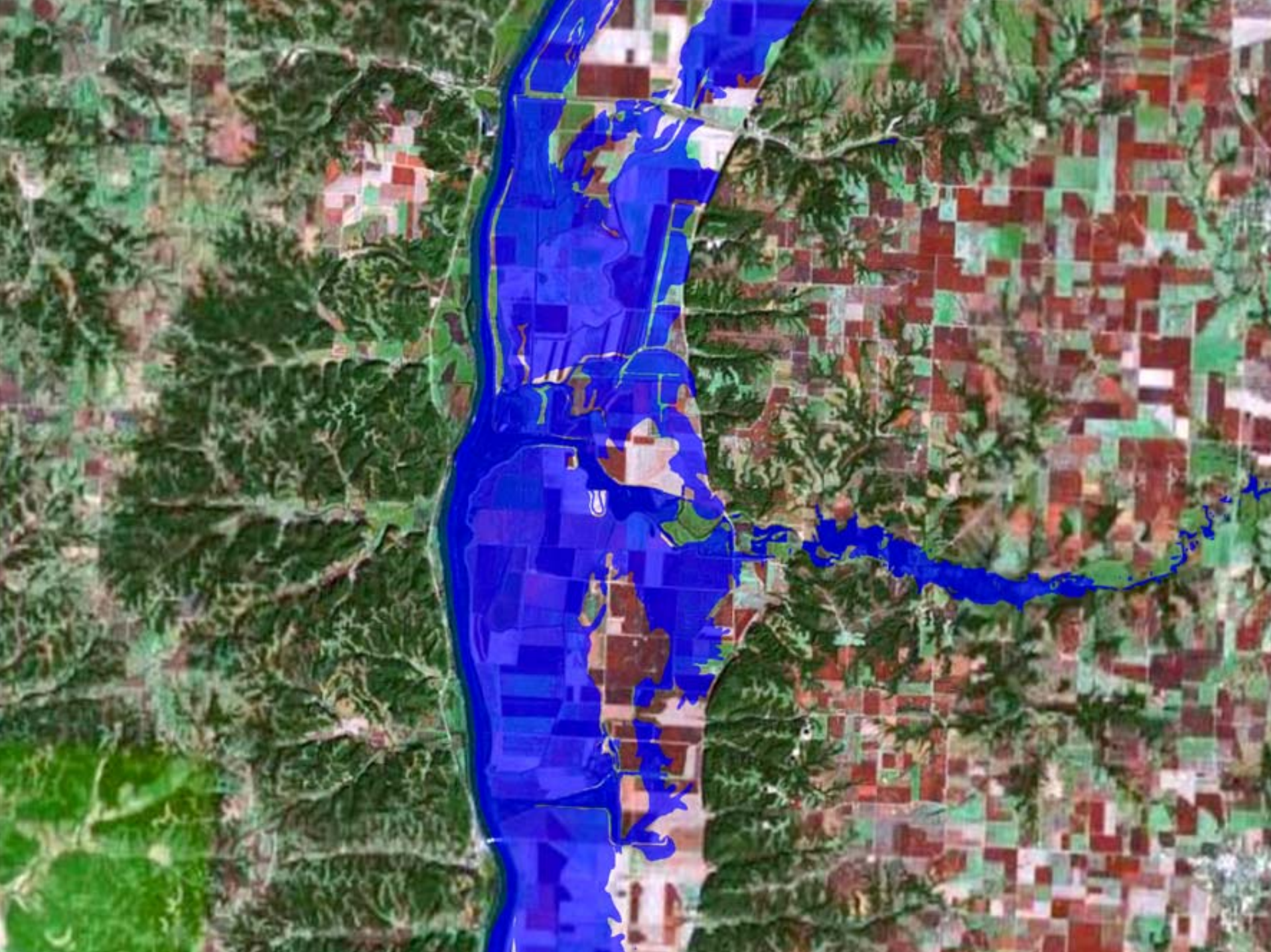
NUTRIENT FARMING

A strategy that:

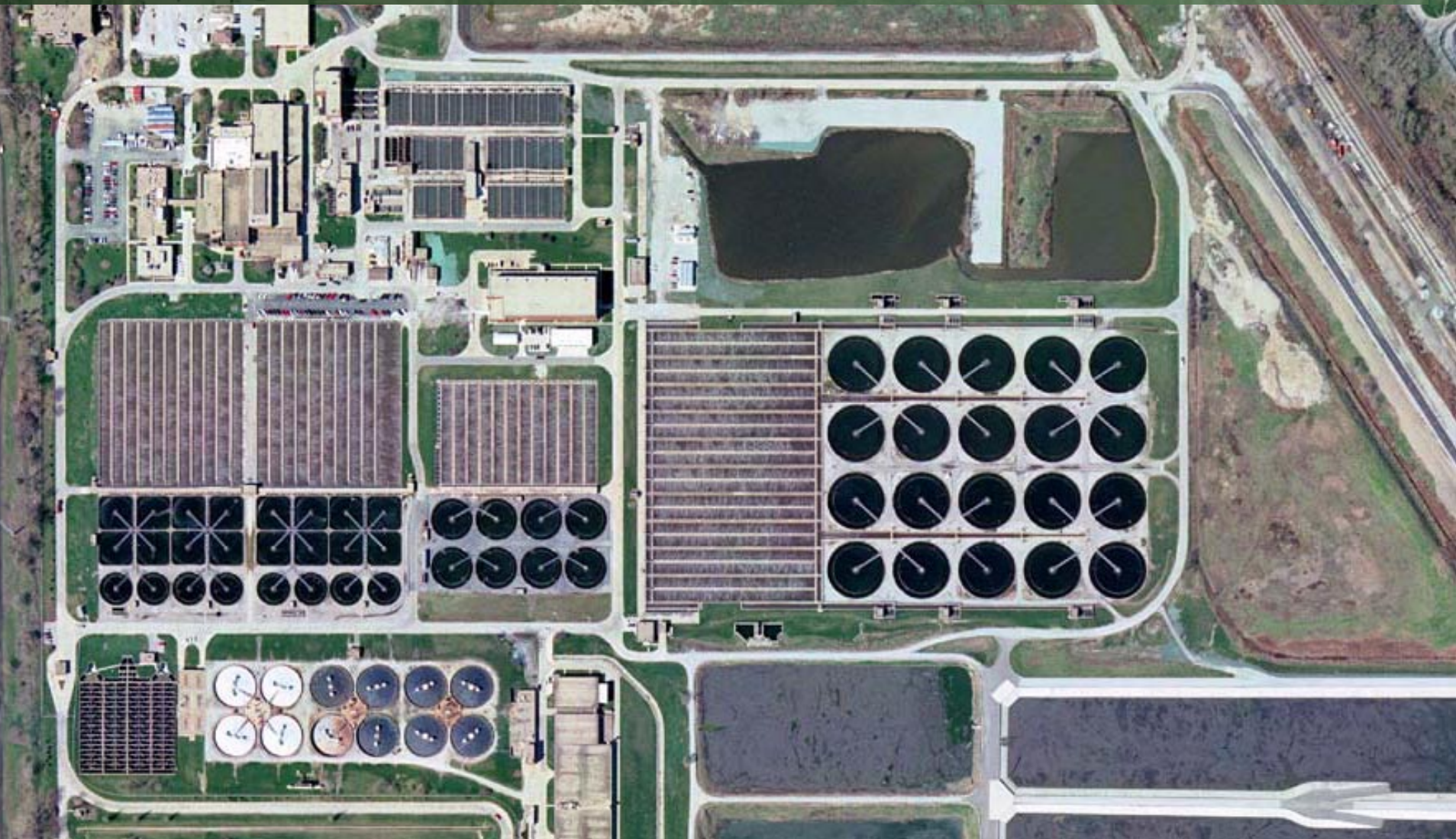
utilizes created and restored wetlands to naturally remove nitrogen and phosphorous from surface waters and CO₂ from the air

is a business enterprise based on the sale of nutrient reduction credits





“Credits” will be sold to dischargers who need to meet water quality standards.



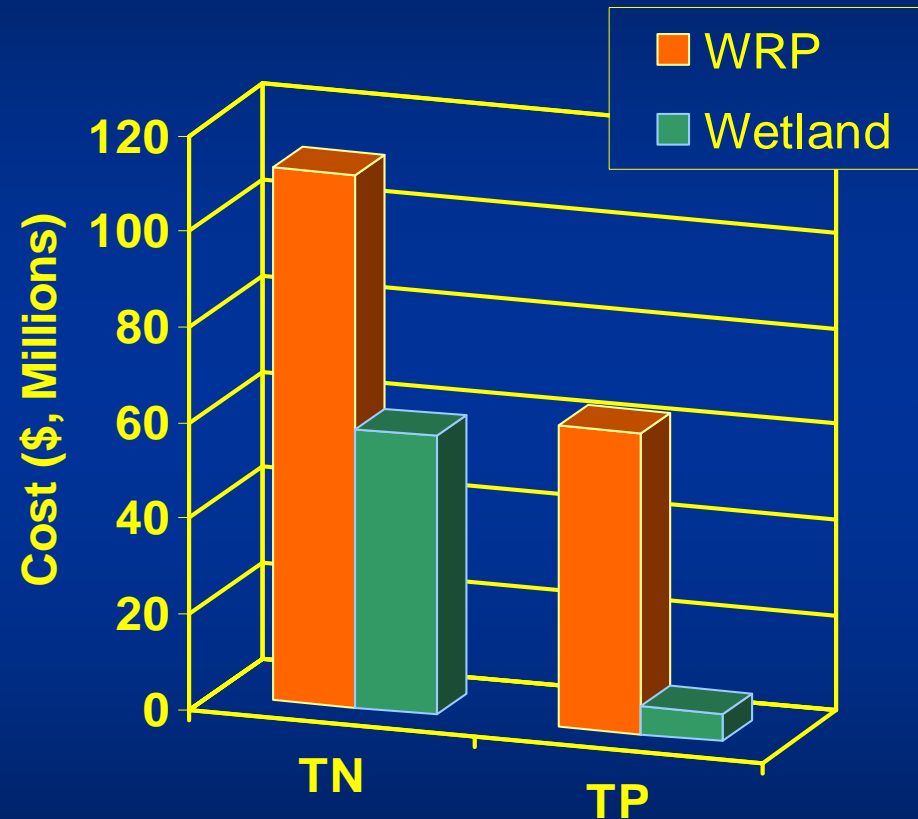
ANNUAL COST COMPARISON OF TREATMENT SYSTEMS

WERF economic analysis:

- Upgrades at 7 Chicago WRPs
- TN and TP removal based on future effluent limits

Wetland Nutrient Farms

- \$110,000,000 savings/year
- 189,000 acres of land required



WERF ECONOMIC COMPARISON

Effluent Limit (mg/L)	Wetland Size (acres)	Total Nitrogen		
		Savings*	50% split of savings	Net Profit/acre
3.0 TN, 1.0 TP	189,000	74,000,000	37,000,000	196
2.18 TN, 0.5 TP	322,000	76,000,000	38,000,000	118

Effluent Limit (mg/L)	Wetland Size (acres)	Total Phosphorous		
		Savings*	50% split of savings	Net Profit/acre
3.0 TN, 1.0 TP	189,000	59,400,000	29,700,000	157
2.18 TN, 0.5 TP	322,000	88,400,000	44,200,000	137

Total annual MWRDGC cost savings: \$66,700,000-\$82,200,000

Total annual Nutrient Farmer net profit: \$255-\$353/acre

* includes sale of extra credits

KINSHIP MARKET ANALYSES

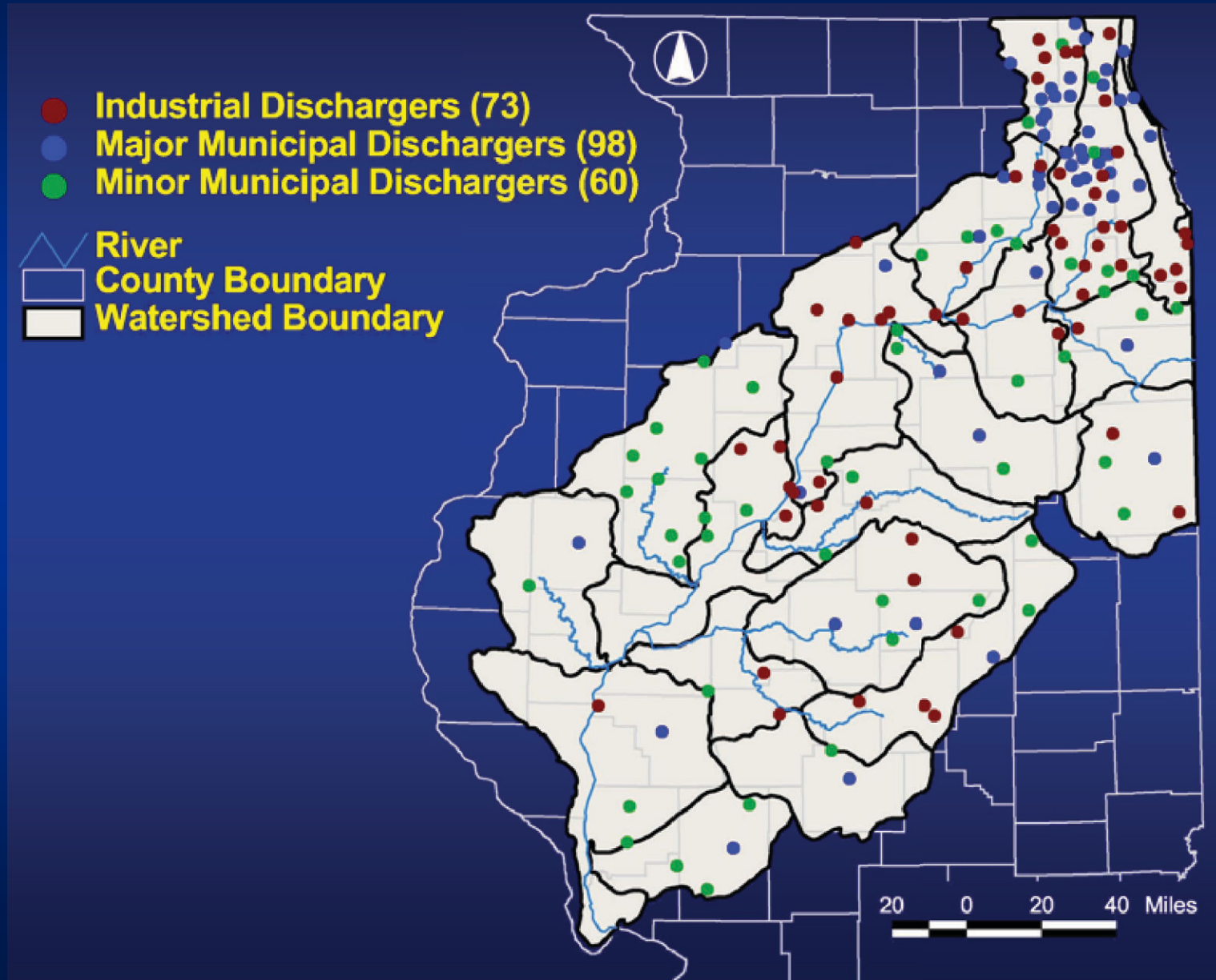
MARKET STRUCTURE:

- Removal of TN load from the Illinois River Watersheds
- Competitive market structure
- Linear programming model
 - Minimize cost for wetland TN removal
 - Optimize allocation of credits among watersheds

MARKET COMPONENTS:

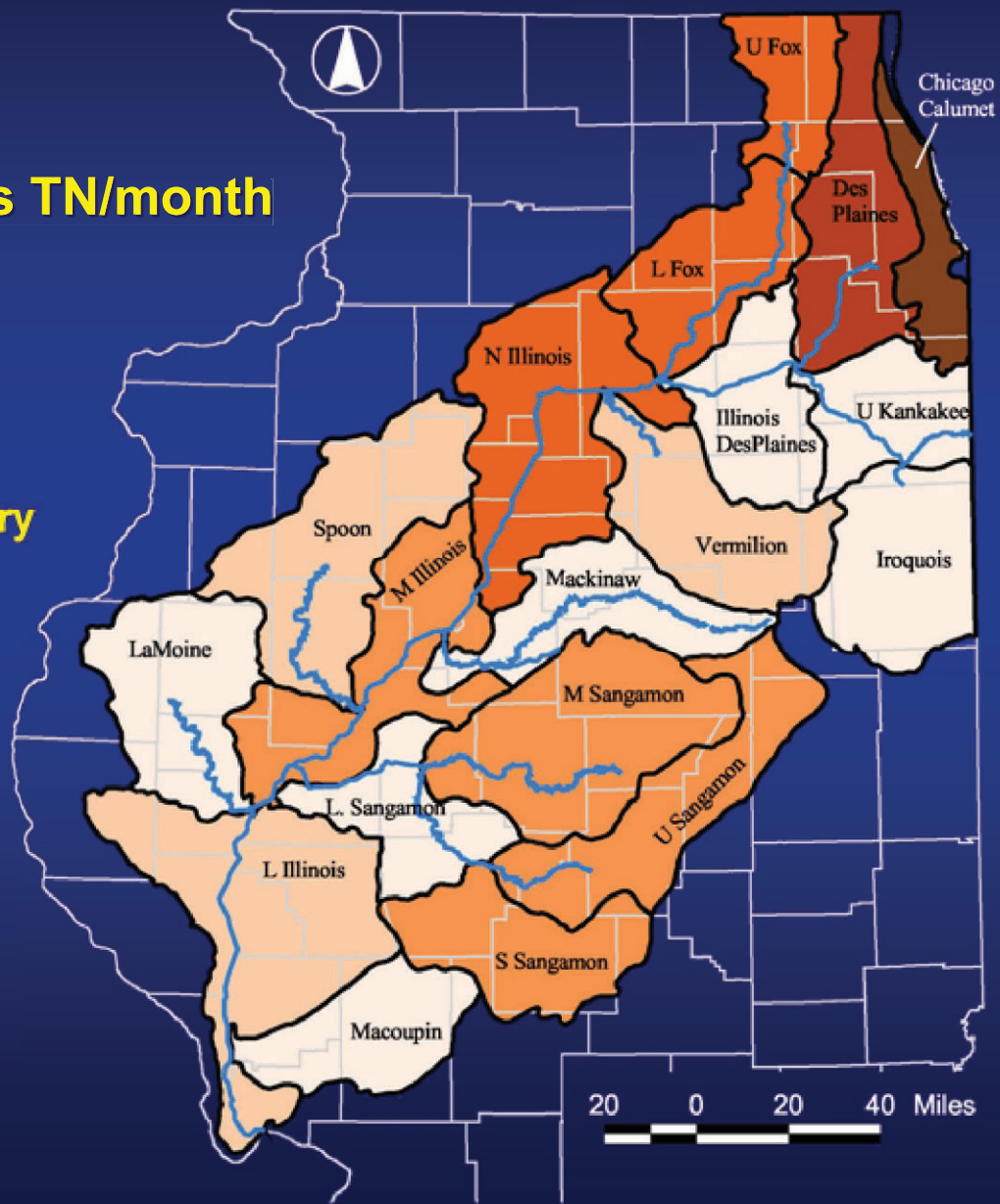
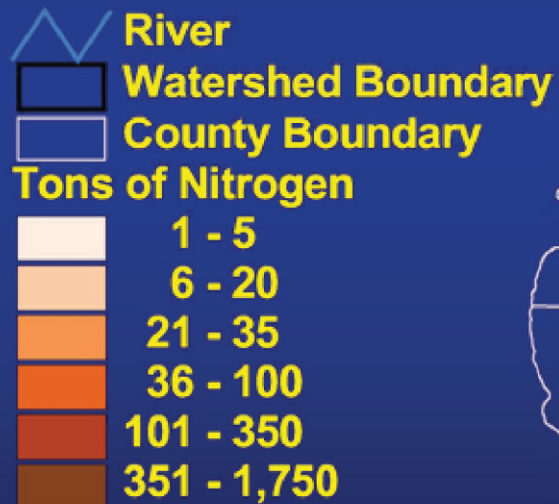
- Demand
- Supply
- Marginal Cost/Total Cost

TN CREDIT DEMAND



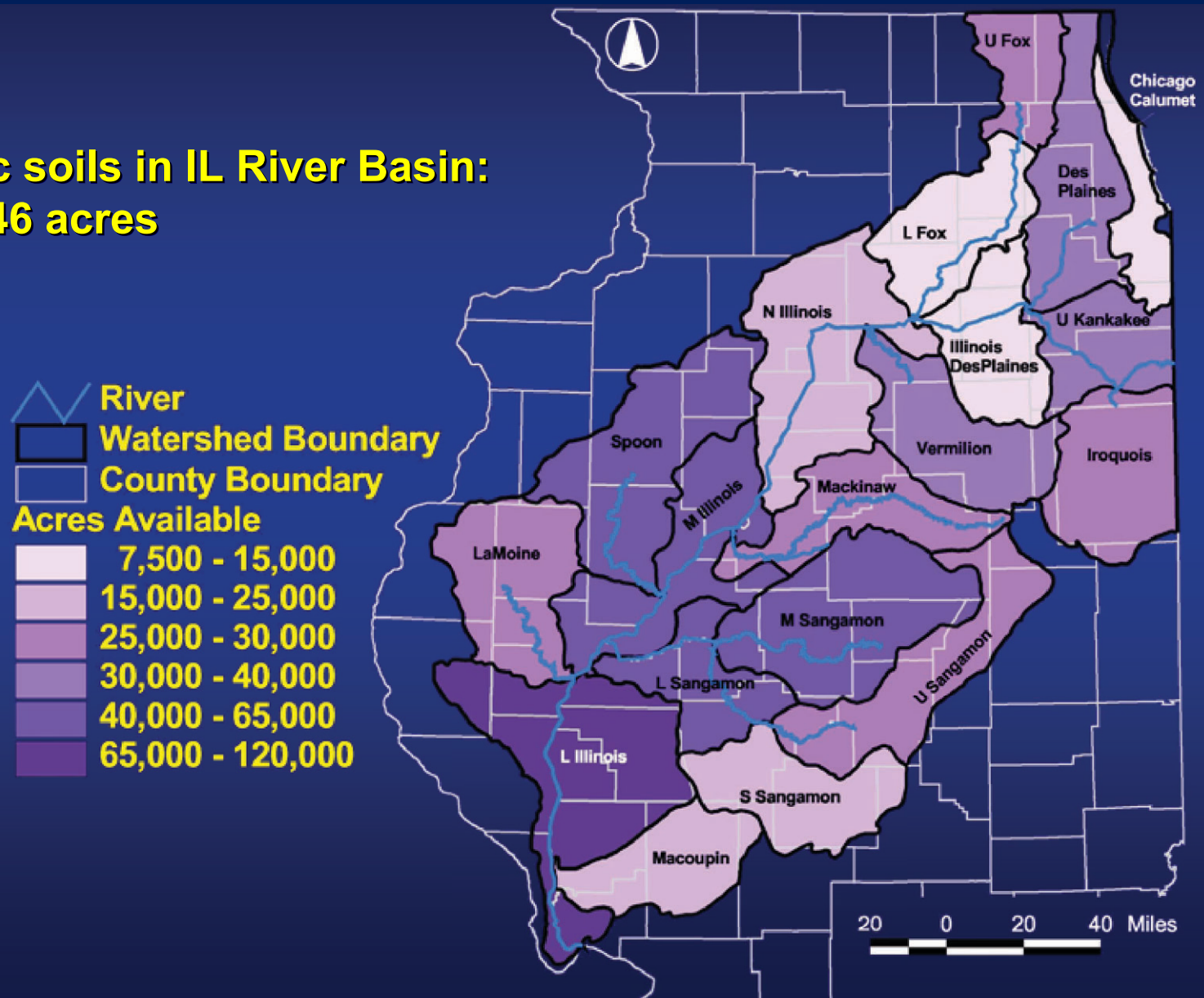
TN CREDIT DEMAND

Total Demand: 2,432 tons TN/month



TN CREDIT SUPPLY: LAND

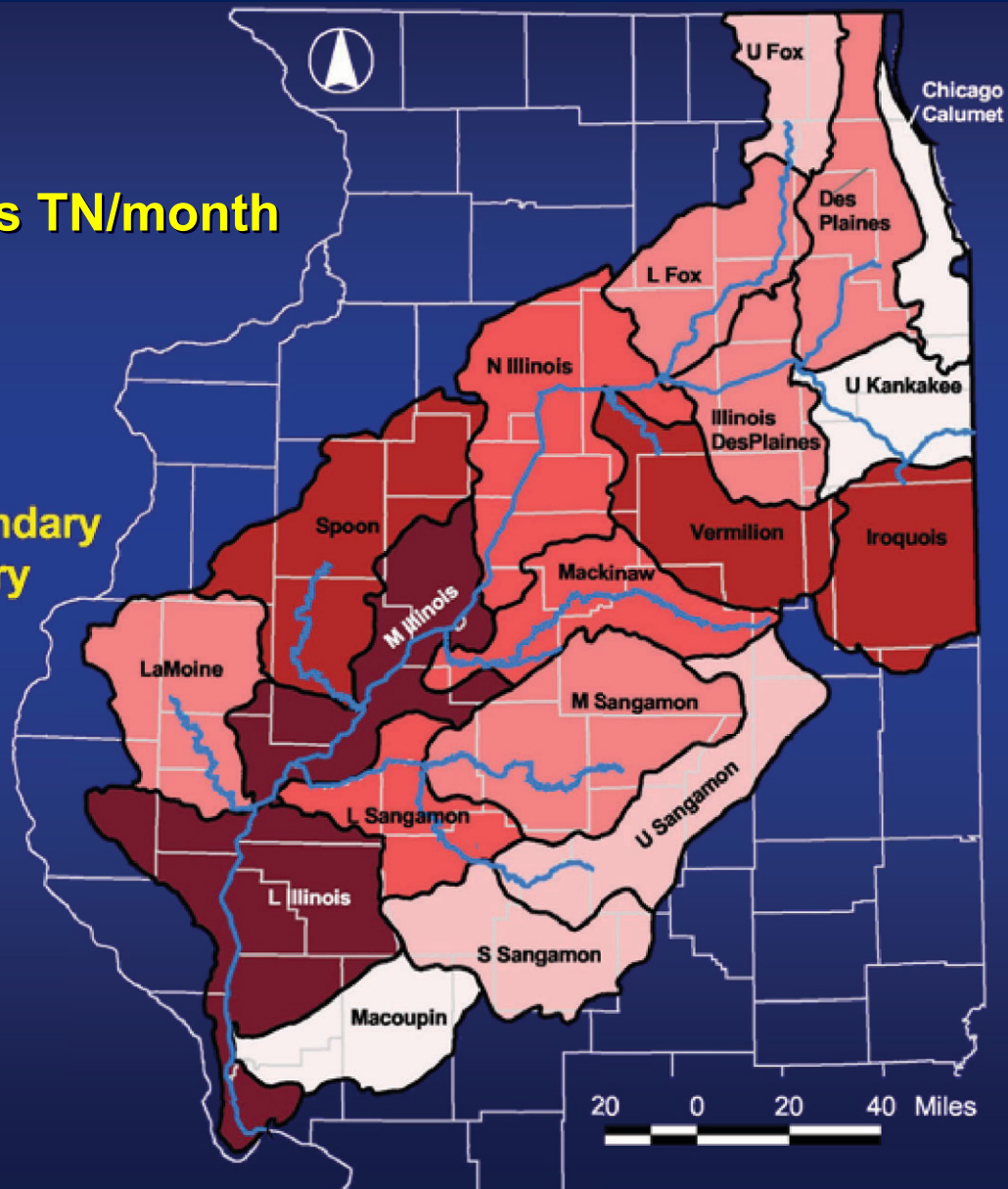
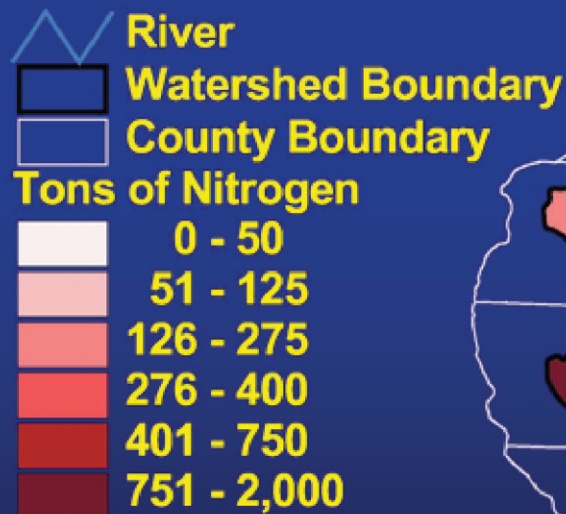
Hydric soils in IL River Basin:
655,146 acres



TN CREDIT SUPPLY: LOAD

Summer

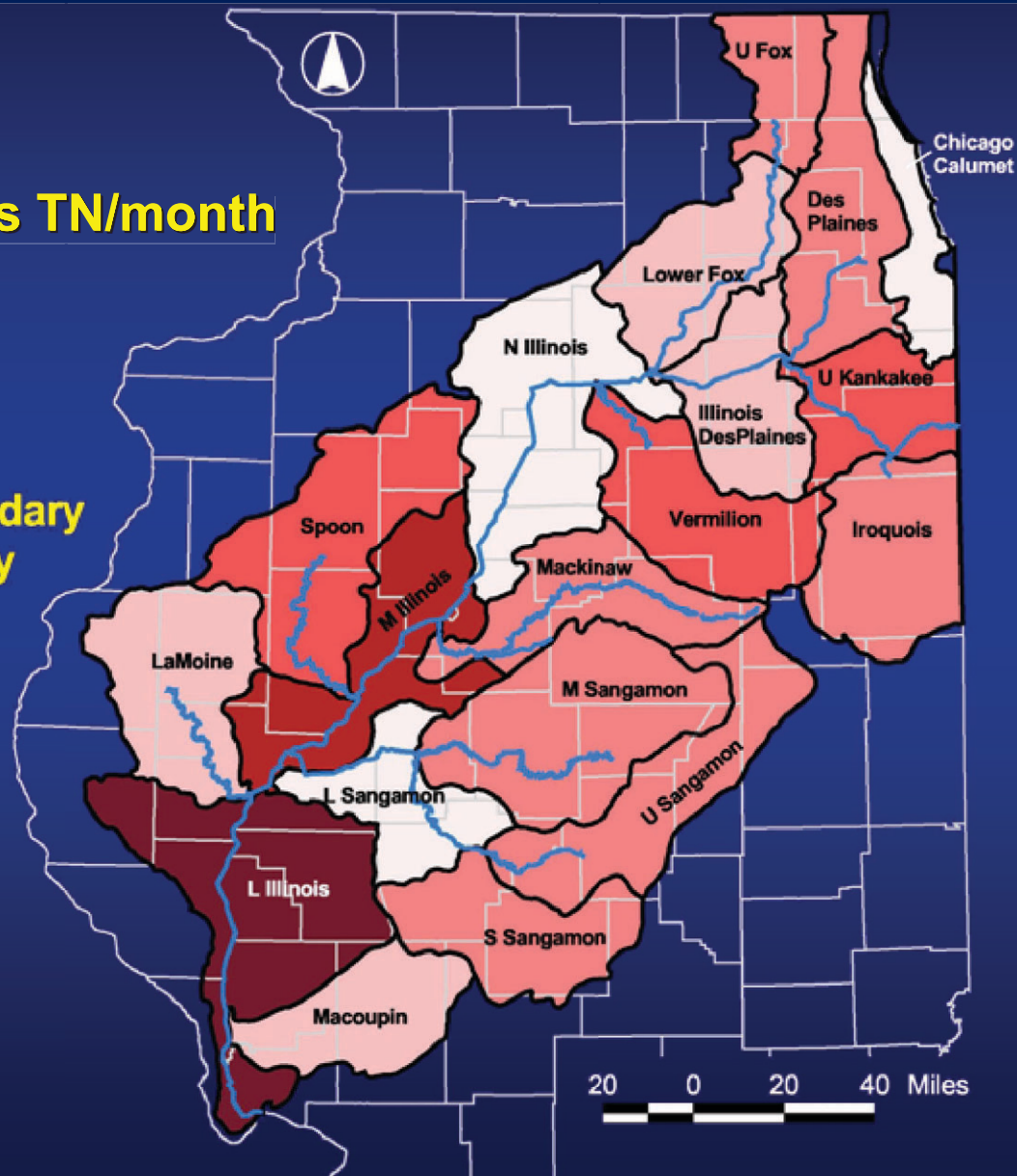
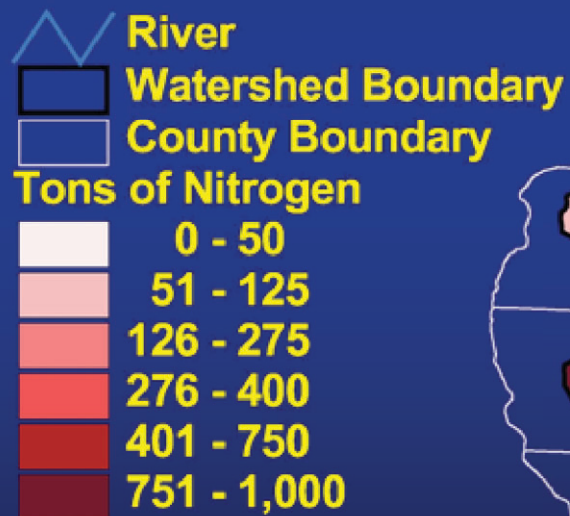
Total Supply: 6,511 tons TN/month



TN CREDIT SUPPLY: LOAD

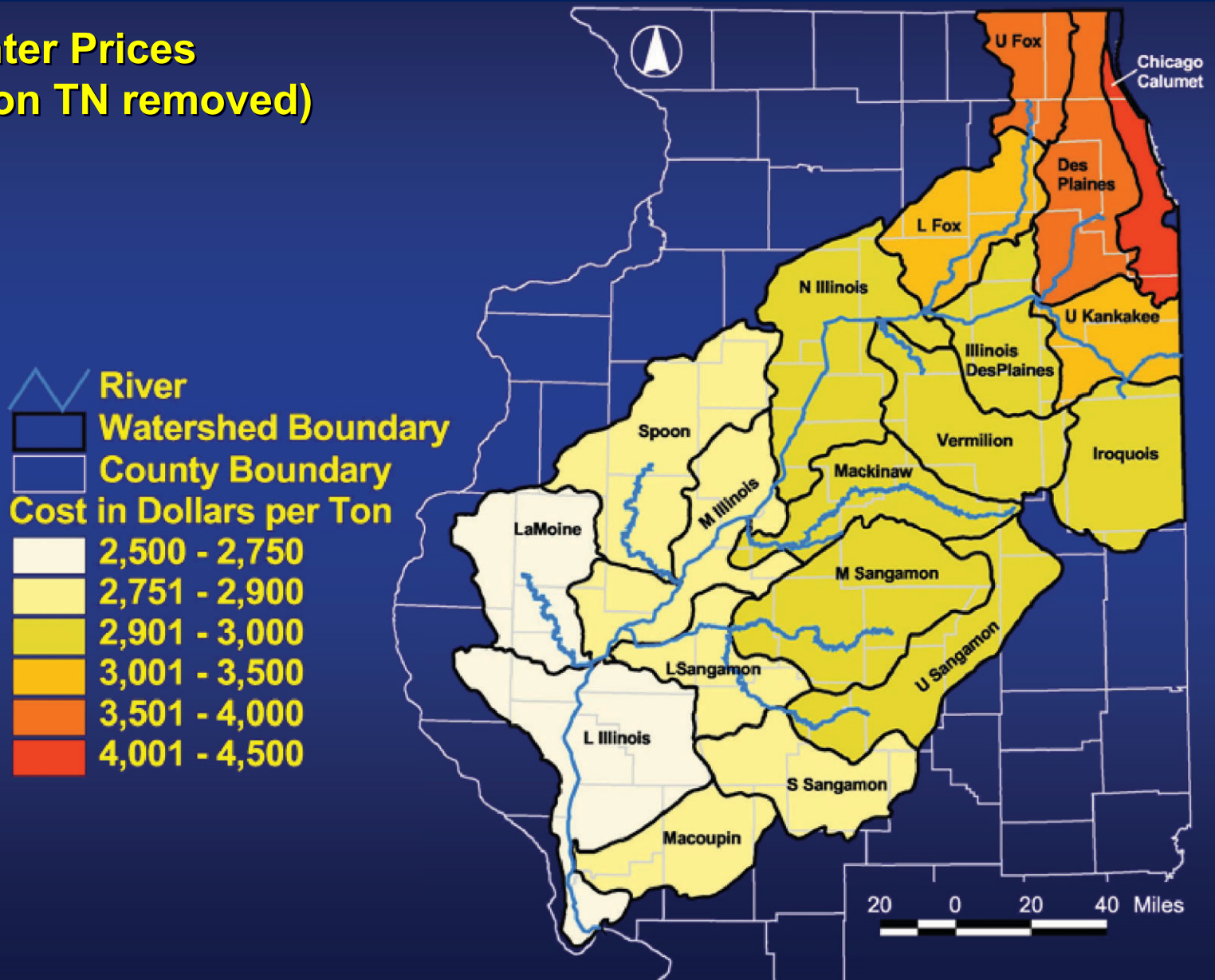
Winter

Total Supply: 4,339 tons TN/month



TN CREDIT COST

**Winter Prices
(\$/ton TN removed)**

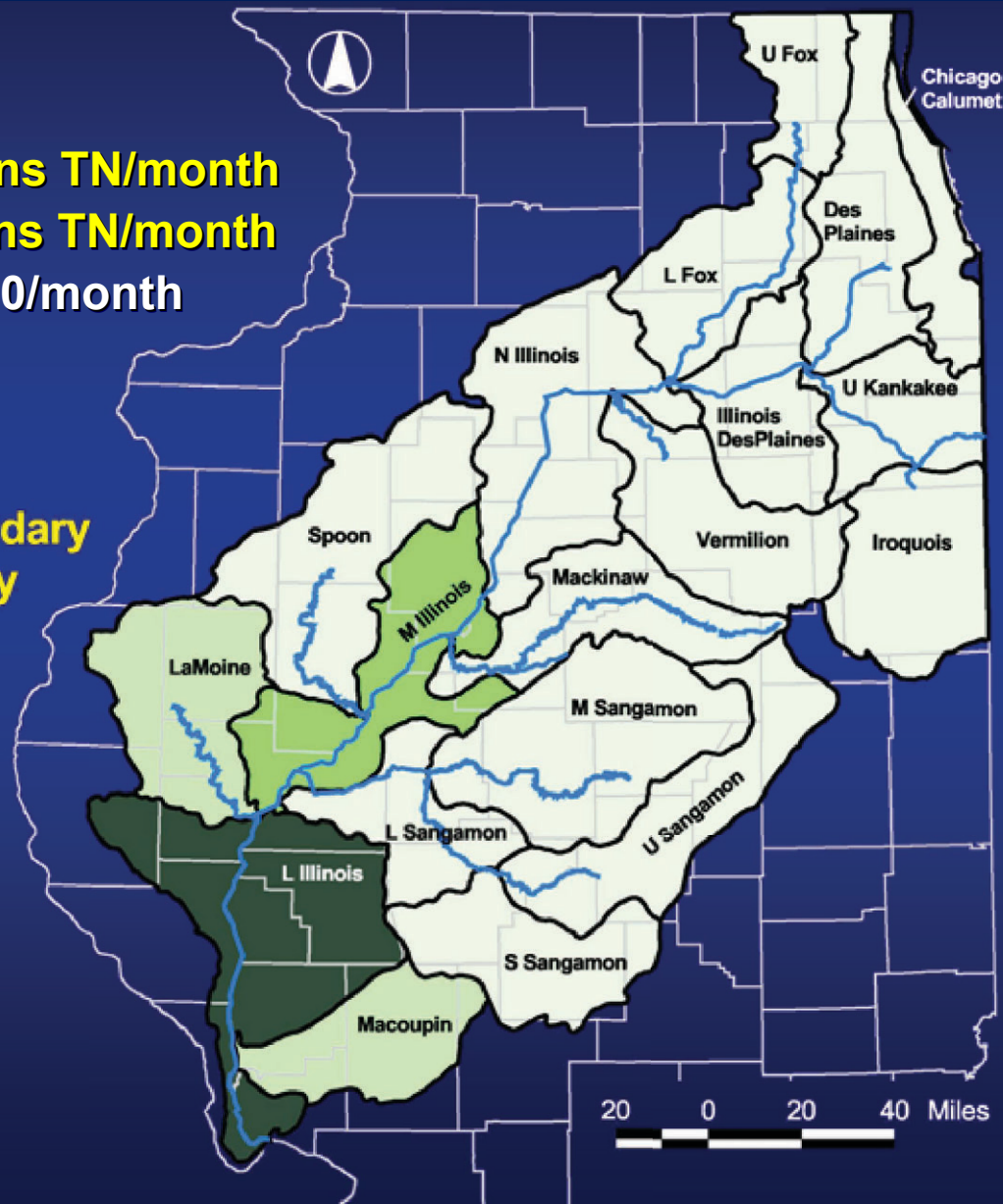
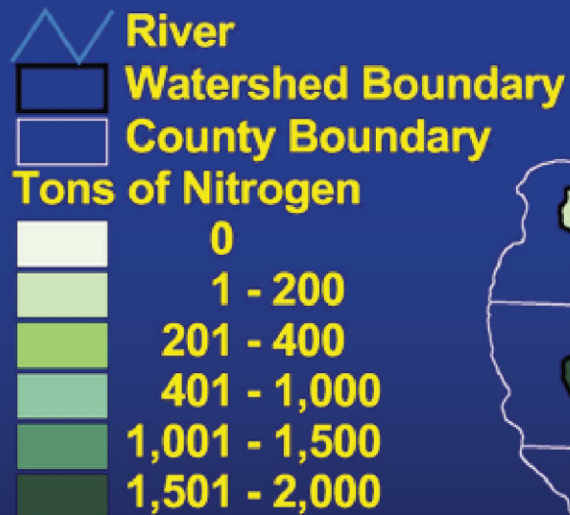


TN TRADE SCENARIO: NO RESTRICTION

Summer Demand: 2,423 tons TN/month

Credits Traded: 2,423 tons TN/month

Total Cost: \$2,285,000/month

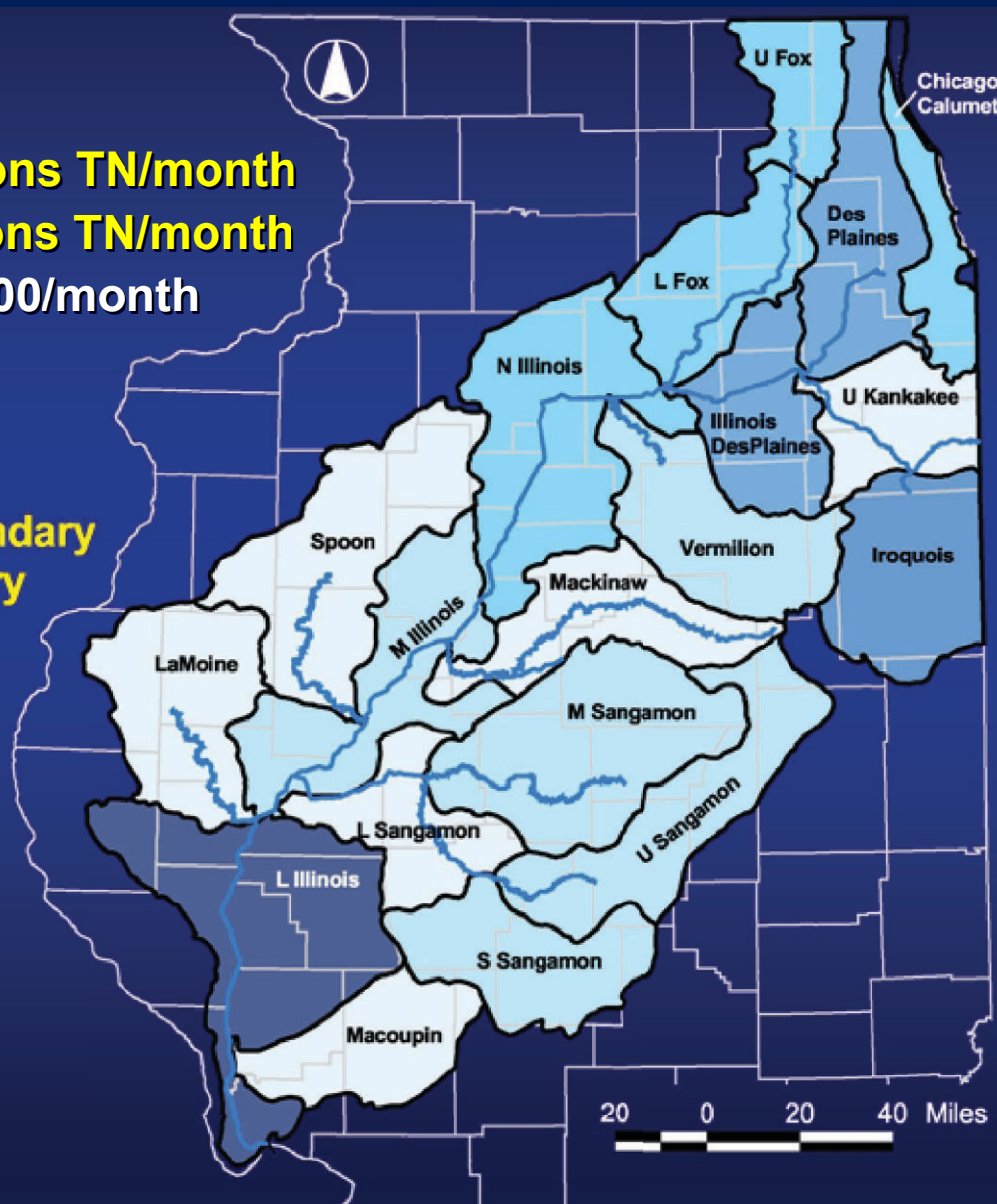
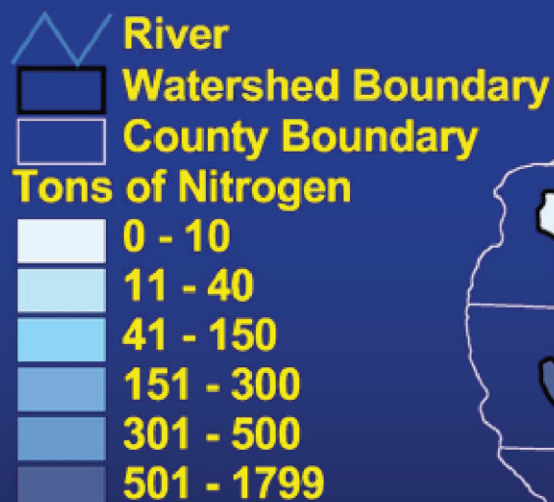


TN TRADE SCENARIO: 10% ACCRUED

Summer Demand: 2,423 tons TN/month

Credits Traded: 2,993 tons TN/month

Total Cost: \$3,005,000/month



TN TRADE SCENARIO COMPARISON

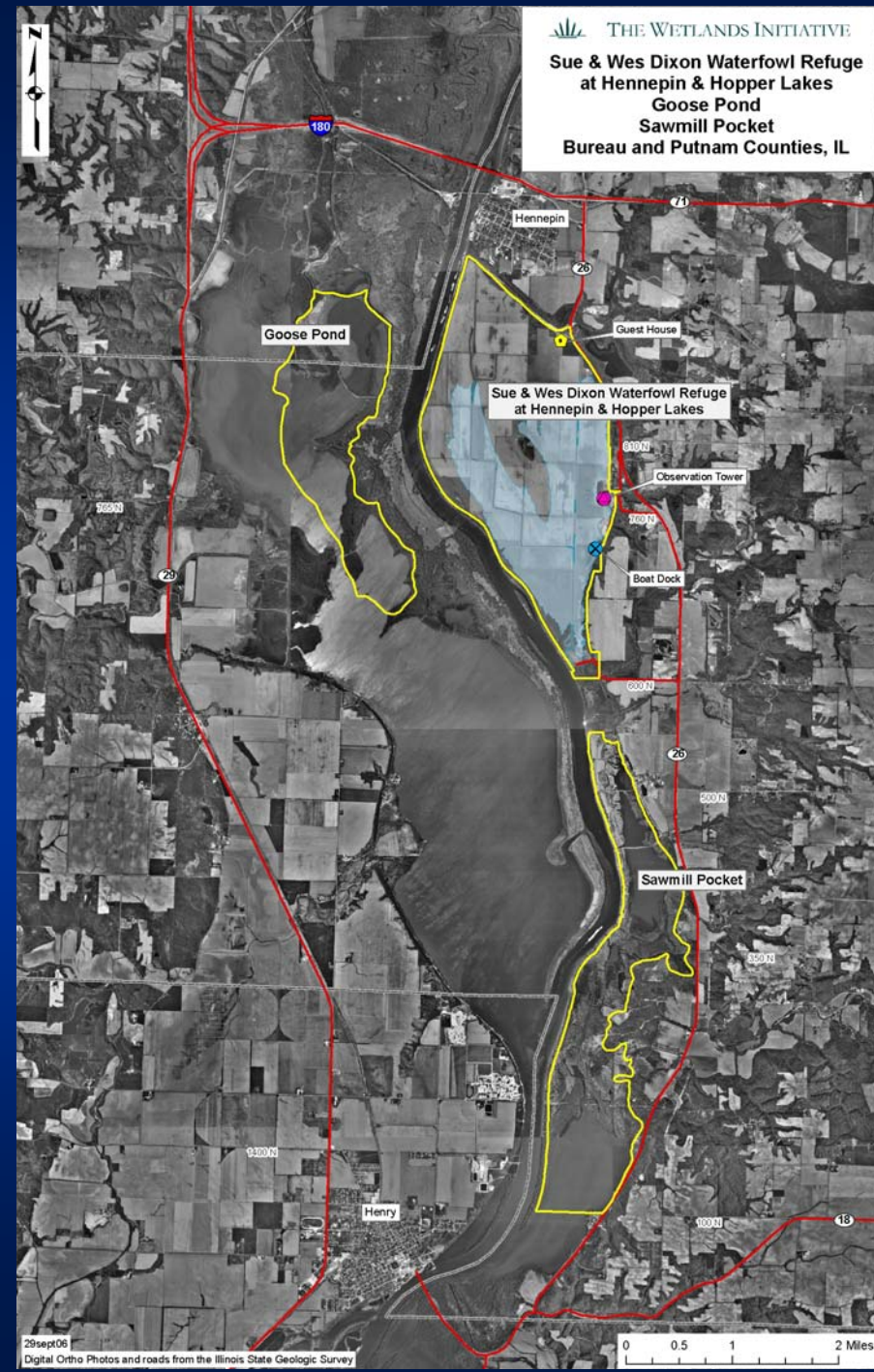
Parameter	Unrestricted	Restricted Intra-watershed	Accrued 10% Penalty
Max. Land (acres)	298,770	298,770	365,110
Credit Price (\$/ton TN)	\$2,405	\$3,424	\$3,394
Annual Costs	\$63,260,000	\$66,190,000	\$83,290,000
Annual Profits	\$6,670,000	\$33,380,000	\$38,170,000
Rate of Return (%) (avg. watershed)	8%	48%	50%

Illinois River Nutrient Farm Pilot Project

Sue & Wes Dixon Waterfowl
Refuge at Hennepin & Hopper
Lakes (2,600 acres)

Sawmill Pocket (1,650 acres)

Goose Pond (1,230 acres)





Nutrient farming provides...

- **Self-sustaining nutrient load reduction (C, P,N)**
- **Point and non-point nutrient control**
- **Increased farm income**
- **Capital for wetland restoration**



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